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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/573,089 | 03/23/2006 | Lester H. Landis JR. | 2004UR001 | 6993 |

7590 04/01/2009

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| EXAMINER | |
|---|---|
| JONES, HUGH M | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2128 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 04/01/2009 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. 10/573,089 | Applicant(s) LANDIS ET AL. | |
|---|---|---|---|
| | Examiner Hugh Jones | Art Unit 2128 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on _23 March 2006_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) _1-56_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-56_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _23 March 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _4/20/06 3/23/06_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

1. Claims 1-56 of US Application 10/573,089, filed 3/22/2006, are presented.

### *Claim Rejections - 35 USC § 101*

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claims 1-56 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter since the claims as a whole: 1) are not proper process claims and 2) are directed to abstract ideas.

1) the claims are not proper process claims: There is no tie to another statutory class (or transformation of matter). A valid process under 35 USC § 101 must either 1) operate to change articles or materials to a different state or thing, or 2) be tied to a particular machine or apparatus. In order to qualify as a statutory process, the claim should positively recite the other statutory class to which it is tied, for example by identifying the apparatus that accomplishes the method steps. Further, a recitation of a computer in the preamble does not appear to be sufficient to tie the process to a particular apparatus. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone (**See In re Hirao**,

535 F.2d 67, 190 USPQ 15 (CCPA 1976) and Kropa v. Robie, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1.951)).

2) the claims are directed to abstract ideas: the claims are drawn to defining finite elements for a model - providing cells for a three dimension abstract model representation of a spatial region, in this case, a reservoir. There is no practical application, and the claimed invention in fact pre-empts use of the abstract representation (idea) itself.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1-56 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

**a)** While the individual steps can be carried out without difficulty, the overall invention is not enabled for the following reason. The specification does not disclose the criteria for deciding whether to carry out the particular steps. The specification, in general, appears to merely recite the claim limitations, but does not appear to provide further direction. *For example*, compare claims 1, 27:

1. A method for generating a reservoir model, comprising:
providing a first framework having a plurality of cells,

wherein the first framework is a reservoir framework; and providing a second framework having a plurality of cells, *wherein the volume of the first framework is greater than the volume of the second framework.*

27. A method for generating a reservoir model, comprising: providing a first framework having a plurality of cells, wherein the first framework is a reservoir framework; and providing a second framework having a plurality of cells, *wherein the volume of the second framework is substantially the same size as one of the cells of the first framework.*

Clearly a skilled artisan could carry out the steps without difficulty. But, how would the artisan know when to do one or the other? The two claims refer to mutually exclusive steps, and a choice would have to be made between one and the other.

**b)** The claims refer to two frameworks. How are they related to each other? Do they correspond to independently run simulations? Are the two meshes nested or independent?

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-56 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The claims refer to two frameworks. How are they

related to each other? Do they correspond to independently run simulations? Thus, it appears more steps are required that tie the two frameworks together in the modeling.

8. Claims 1-56 are also rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are those between the two frameworks. How are they related to each other? Do they correspond to independently run simulations? Thus, it appears more steps are required that tie the two frameworks together in the modeling.

### *Claim Interpretation*

8. It is unclear whether the invention is directed to a nested mesh, a hybrid mesh or a dual mesh, and, if the later, whether the dual meshes are connected or are independent. For this reason and for the reasons provided earlier, the state of the claims in the instant application precludes a limitation-by-limitation assessment of the claimed invention compared to the prior art. The Examiner cannot interpret the meanings of the claims without relying on considerable speculation. See *In re Steele*, 305 F.2d 859,134 USPQ 292 (CCPA 1962). However, in the interests of compact prosecution, an art rejection is applied.

### *Claim Rejections - 35 USC § 103*

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

> invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

> 1. Determining the scope and contents of the prior art.
> 2. Ascertaining the differences between the prior art and the claims at issue.
> 3. Resolving the level of ordinary skill in the pertinent art.
> 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 1-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sabathier et al.

12. Sabathier discloses a dual mesh strategy for fracture modeling including defining the sizes of the two meshes, but does not appear to expressly disclose all particular combinations as recited in the claims. However, it appears that the particular combinations depend upon the intended use/problem to be solved, including, for example, fracture layer thickness.

13. Sabathier discloses

- discloses geologic modeling (page 2):

page 2: To describe the whole fracture network which includes billions of fractures, we combine two descriptions of the medium, the global model and the local model:

1. The *global model* is a discretized 2D map of the reservoir (**Fig. 2**). <u>Average fracture properties are assigned to each cell of this model</u>. These include the parameters of the statistical distributions of fracture lengths, fracture orientations,

fracture spacing, and fracture fluid flow conductivity for each fracture set identified. Distribution of cell fracture properties among the reservoir is either determined in a deterministic way from curvature analysis, <u>geomechanical modelling</u> and data interpolation, or by a <u>geostatistical simulation</u>.

2. The *local model* is a 3D object-oriented modelling of the fracture network at a given location pointed in the global model. <u>At this local scale, the medium is represented by a multi-layer rock mass with horizontal parallel interfaces</u> (Fig. 2). A lithologic facies can be assigned to each stratum if a sedimentological model is available. Fracture average properties are supposed to be laterally uniform whereas the vertical distribution of fractures is dictated by the succession of lithologic facies. Then, the medium is populated with rectangles representing the fractures; top and bottom edges are on the layer interfaces. Fractures may extend over many layers. The fracture network is created by a random process. Fractures are generated one by one according to the following procedure: • a point is selected randomly in the multi-layer domain, • at this point, the fracture is initiated as a sub-vertical rectangle extending over a single layer. The fracture length, orientation and fluid flow conductivity are also drawn at random in statistical distributions the parameters of which are given by the global model, at the location of the local scale modelling. • then, vertical extension of the fracture results from an incremental growth process in which the fracture propagates from one stratum

to the other, according to a given probability of abutting at each strata interface. In each stratum, a random procedure decides whether the fracture will extend to the adjacent strata. This last step is repeated until the vertical propagation of the fracture is interrupted.

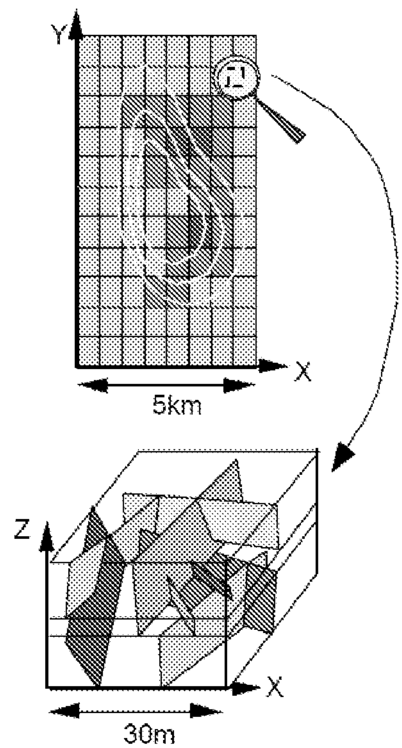


Fig. 2— Combined global and local modelling; the global model consists of maps of average fracture pr

14. Sabathier discloses converting the geologic model into a *dual-porosity model*.

Page 2, col. 2 to 3, col. 1:

**How to convert the geological model into a conventional dual-porosity model?** A methodology is presented here to compute equivalent fracture permeabilities and equivalent block size to be directly input in a dual-porosity model.4,5 **Methodology input.**

A general format has been defined to describe the fractured volume used as an input for our methodology and software. In this format, the 3D image is discretized as a list of layers. Each layer includes fracture plane elements (rectangles) defined by a fracture set number, an origin, orientation, length, neigbouring rectangles, and a conductivity or an aperture. As shown in **Fig. 4**, a single fracture is represented with several connected rectangles.

…

**Equivalent permeabilities.** In a dual-porosity simulator, fracture flows and matrix flows are computed within <u>**two distinct grids**</u>. Therefore, the fracture network alone is taken into account to compute equivalent fracture permeabilities.
Incompressible steady-state flows are computed in each of the 3 directions of the 3D fracture network, with either a zero-flow-rate condition or a linearly varying pressure condition applied on the lateral limits (**Fig. 5**). To do so, the fracture network is discretized as nodes placed at rectangle intersections, and a mass balance equation is written for each node of the discretized network. I<u>n this equation, flow rates are expressed using Darcy's law and the transmissivity between two nodes is computed as a function of fluid viscosity and of the dimensions and conductivity of the fracture element linking them</u>.

A conventional dual-porosity model is:

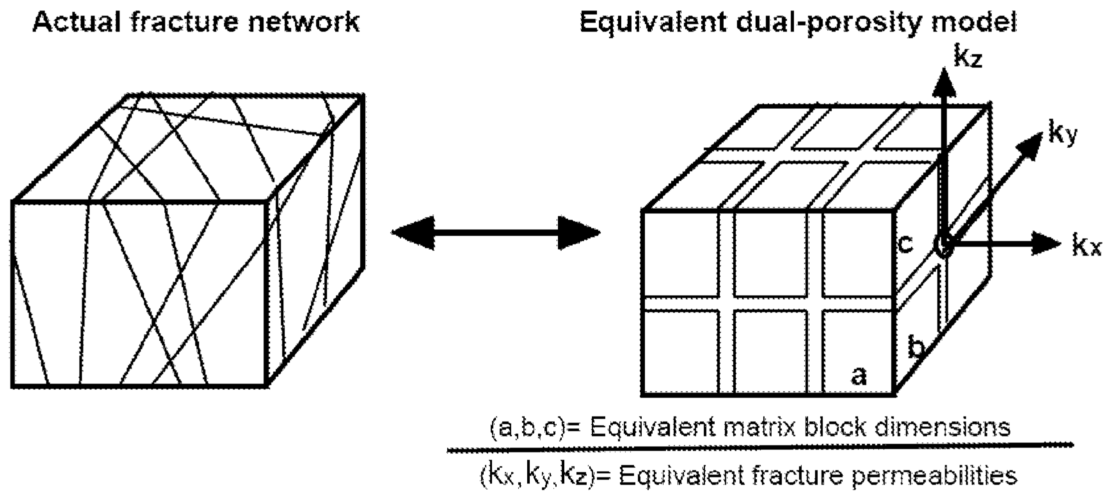


**Fig. 1— Conventional Warren and Root representation of a fractured reservoir (gridblock scale)**

The size of the matrix blocks are calculated (pg. 3):

**Equivalent block.** Since fractures are vertical in the 3D fractured volume, matrix blocks are not limited by fracture planes in the vertical direction and no vertical dimensions of equivalent blocks needs to be determined. Hence, the method described hereafter enables to compute the horizontal dimensions of equivalent blocks for each layer of the image and for several layers lumped together. In a given layer, the problem addressed is that of finding the horizontal dimensions of the equivalent block for which the real medium and the equivalent rectangular model give similar oil recovery functions for a water-oil capillary imbibition process. To this end, a simple and fast procedure, denoted as the geometrical method, has been developed (**Fig. 6**). It is a simplified representation of the imbibition

mechanism based on the two following assumptions, (1) the invasion of matrix by water is piston type, (2) the water front invasion kinetics is the same in all blocks of the layer. Therefore, instead of comparing the recovery functions versus time, the identification of the two media is performed using the normalized invaded area versus distance of water invasion functions. For the equivalent medium, this area versus distance function has an analytical expression depending on the horizontal dimensions of the equivalent block *(a,b)* and the distance of water invasion from block boundaries. For the real medium, this function is derived from a pixel type discretization of the layer using an image processing algorithm. For each pixel, the minimal distance between this pixel and the nearest fracture is computed, an histogram of the resulting pixel values is calculated and the normalized area function is derived from this histogram. Finally, the horizontal dimensions of the equivalent block, *a* and *b*, are determined through a procedure minimizing the difference between the area versus distance functions of the two media.5

A validation case is presented in **Fig. 7**. The "real" block is a rectangular block partially penetrated by several fractures (Fig. 7.a). The equivalent block is in grey in the same figure. Fig. 7.b shows that the recovery curves are practically the same for the "real" and equivalent blocks (as obtained with a finely-discretized single-porosity model).

15. Sabathier discloses discloses (pg 4) the relationship between the two meshes:

**"How to compute matrix-fracture transfer terms ? Basic formulation.** In a dual-porosity dual-permeability model, flows are computed within two superposed grids, respectively fracture and matrix grids."

See also fig. 6:

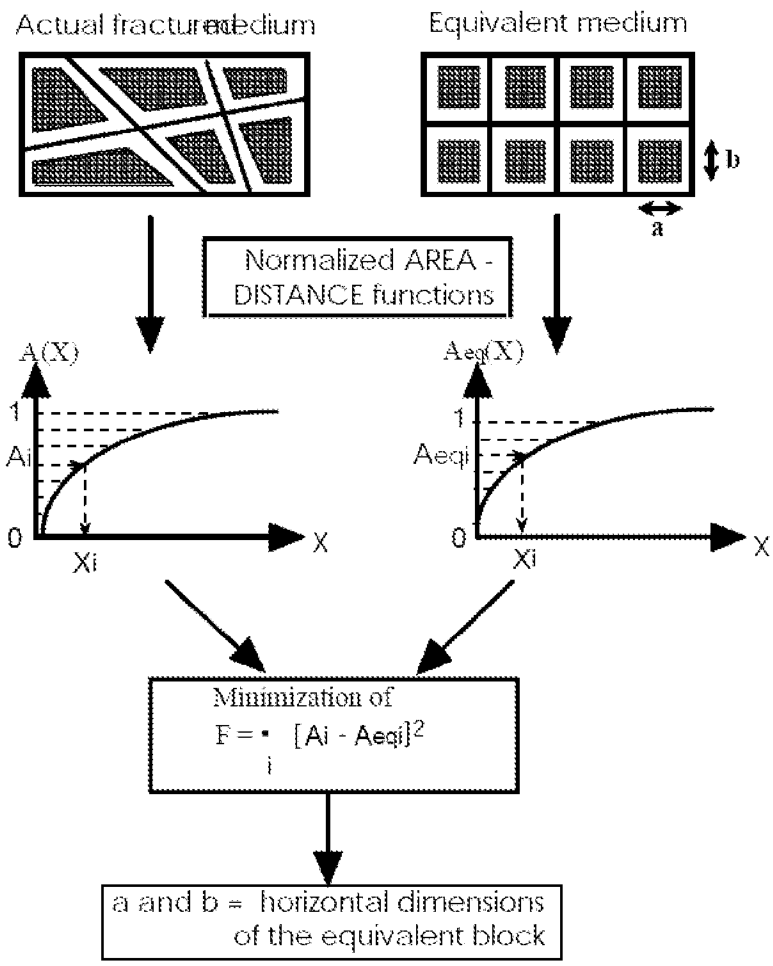


**Fig. 6— The geometrical method**

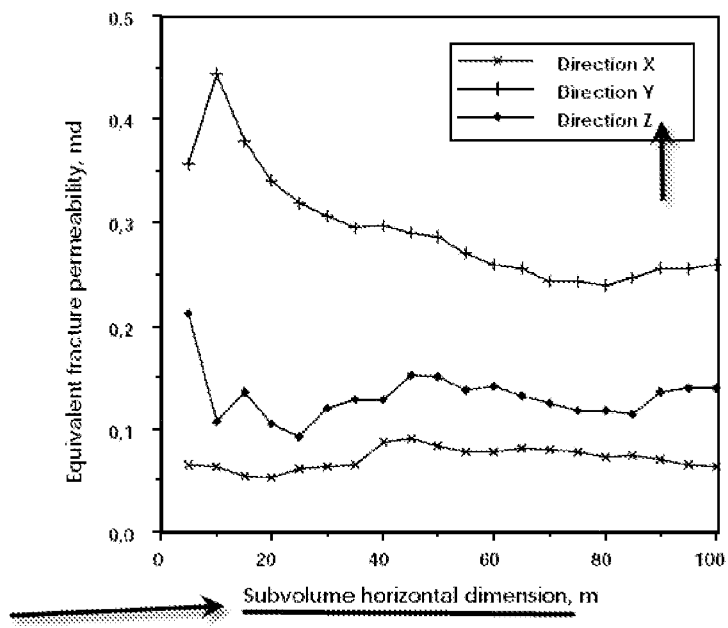


**Fig. 8— Equivalent fracture permeabilities in the demonstrat**

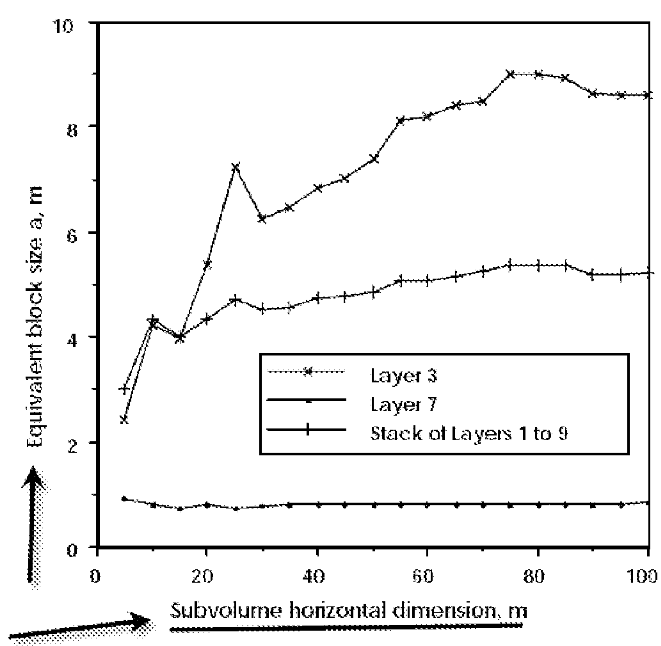


**Fig. 10— Equivalent blocks in the demonstration image. Evolution with subvolume size.**

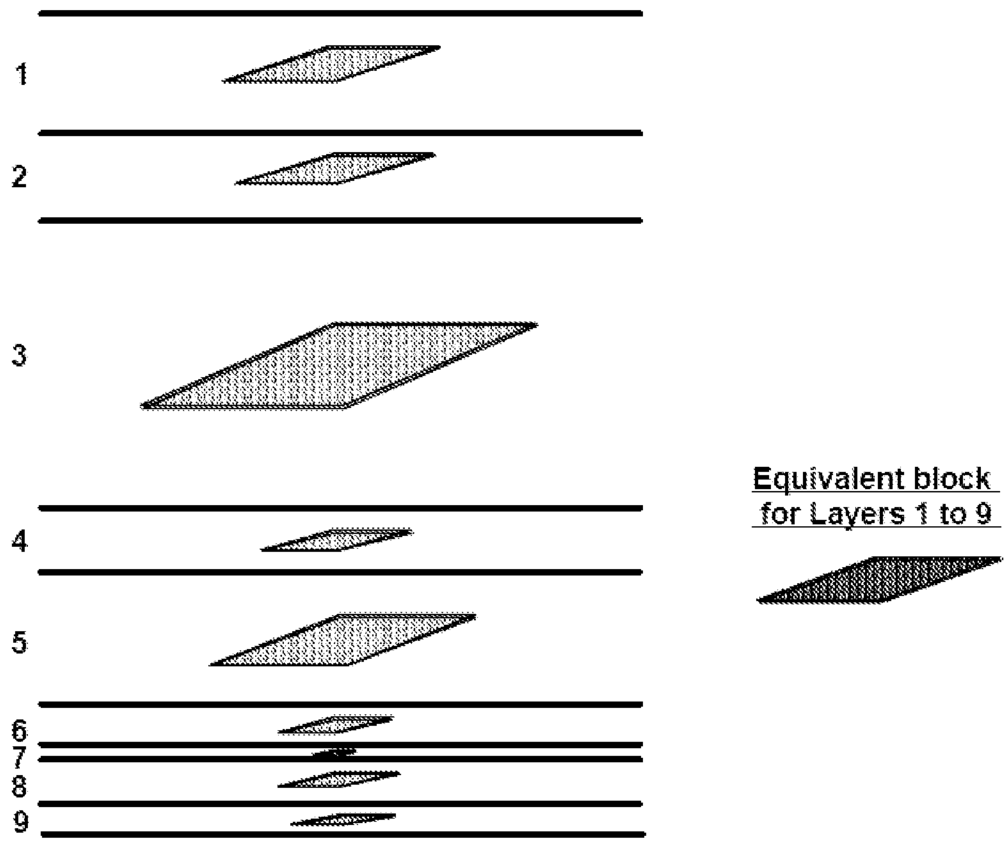


Fig. 9— Equivalent blocks in the different layers of the demonstra

*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hugh Jones whose telephone number is (571) 272-3781. The examiner can normally be reached on M-Th.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Hugh Jones/
Primary Examiner, Art Unit 2128